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Initial conditions for inflation in an FRW universe

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Abstract

© 2018 American Physical Society. We examine the class of initial conditions that give rise to inflation. Our analysis is carried out for several popular models including Higgs inflation, Starobinsky inflation, chaotic inflation, axion-monodromy inflation, and noncanonical inflation. In each case we determine the set of initial conditions that give rise to sufficient inflation, with at least 60 e-foldings. A phase-space analysis is performed for each of these models and the effect of the initial inflationary energy scale on inflation is studied numerically. This paper discusses two scenarios of Higgs inflation: (i) the Higgs is coupled to the scalar curvature, and (ii) the Higgs Lagrangian contains a noncanonical kinetic term. In both cases we find Higgs inflation to be very robust since it can arise for a large class of initial conditions. One of the central results of our analysis is that, for plateau-like potentials associated with the Higgs and Starobinsky models, inflation can be realized even for initial scalar field values that lie close to the minimum of the potential. This dispels a misconception related to plateau potentials prevailing in the literature. We also find that inflation in all models is more robust for larger values of the initial energy scale.

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